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Atmospheric observations of the water vapour continuum in the near-infrared windows

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The water vapour continuum is an important additional component to the total absorption of atmospheric radiation by water vapour. However, while it has been studied extensively in the far and mid-infrared, there are significant uncertainties in its absorption strength in the near-infrared, since the relatively few laboratory measurements in this region disagree by a factor of ~50. Compounding this uncertainty is the lack of observations in atmospheric conditions; measurements are typically made at room-temperature or above, but the continuum has significant (and uncertain) temperature dependence. We aim to reduce this uncertainty by presenting observations of the near-infrared water vapour continuum from Camborne, UK at sea level using a sun-pointing, radiometrically-calibrated Fourier transform spectrometer in the window regions between 2000–10000 cm^{-1}. When extrapolated to atmospheric temperatures, we show good agreement with various laboratory studies in the 4 μm window. Our results show that the widely-used MT_CKD continuum is too weak by a factor of ~5 in the in the centre of the 2.1 μm window in line with laboratory analyses, with implications for energy balance studies and remote sensing. Our results at 1.6 μm show significantly stronger absorption than MT_CKD. This may be in part due to the influence of atmospheric aerosol, which forms a rather significant part of the uncertainty in our measurements at higher wavenumbers. We demonstrate the difficulties in making such field observations, and highlight the need for future observations both from the laboratory and the field, with the aim of including the water vapour continuum in the HITRAN spectroscopic database.